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An investigation of the possible uses of cumulative record data in predicting college success based on data accumulated in considerable volume by the Educational Records Bureau and the National Registration Office for Independent Schools. This material consists of the records of test scores of pupils in member schools participating in the regular programs of the Educational Records Bureau and the records of high school and college grades contained in the files of the National Registration Office. These data, representing the type of information generally to be found on an individual pupil's cumulative record card and transcripts, made possible a study based on pupils from a number of different schools and an even larger number of colleges.

The following points may be selected as among the more interesting results of this study:

1. Exceptionally good predictions of college success, as measured by average freshman grades, can be made from secondary school course marks and achievement test results, if the grades from different institutions, with varying standards and methods of grading, are put on a common scale by means of conversion procedure such as those reported in the study.

2. The CEEB (College Entrance Examination Board) Scholastic Aptitude Test scores are more closely associated with college grades than are the results of the ACE (American Council on Education) Psychological Examination taken during the regular testing programs in the schools, but neither one of these aptitude tests approaches the achievement test results in predictive value. The correlations of reading test scores with the criterion are of about the magnitude as those of the ACE test.

3. School marks predict the criterion more accurately for boys than for girls; test results predict better for girls.

4. As a general rule, school marks furnish a somewhat better prediction of college success than do achievement test results; the difference is not great for the independent school pupils, but is larger for the public school groups.

5. After grade 9, either achievement test results or course marks for any one year are about equal to those for any other year, and are not greatly inferior to 4-year averages in predictive value. The fact that the 10th grade measures give about as good predictions as those for grade 11 or grade 12 should encourage early formulation of college plans, since it appears that good college material may be identified with some accuracy as early as the 10th grade.

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THE APPLICATION OF SECONDARY-SCHOOL CUMULATIVE RECORD DATA TO THE PREDICTION OF COLLEGE SUCCESS

By

Geraldine Spaulding

A Report on Research Conducted under a Grant from

the College Entrance Examination Board

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THE APPLICATION OF SECONDARY-SCHOOL CUMULATIVE RECORD DATA TO THE PREDICTION OF COLLEGE SUCCESS

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THE APPLICATION OF SECONDARY-SCHOOL CUMULATIVE RECORD DATA TO THE PREDICTION OF COLLEGE SUCCESS

By

Geraldine Spaulding

Educational Records Bureau

Introduction

The various problems connected with college admission, and in particular with the prediction of college success, are steadily increasing in importance because of the growing number of students seeking entrance to college, and the difficulties the colleges face in attempting to provide adequate facilities. Many colleges now have far more applicants than they can possibly admit to their classes, and the pressure promises to become still more acute in the future.

This situation makes the problem of predicting success in college even more urgent than it has been in the past. Innumerable studies of the prediction of college success have been made, but in recent years they have not succeeded in bringing to light any greatly improved methods of prediction. Correlations with college grades of the various predictors studied have usually centered around .50. Some of the studies have dealt with students in a single school or college, or in a restricted geographical area; many of them have been limited to the investigation of the predictive value of a single test or other measure, or of a combination of only two or three such measures.

Questions have been raised recently about the relative merits of a single measure, or a small number of measures, obtained shortly before college entrance, and of more extensive information about the student's development, as bases for predicting his college success. With the increasing emphasis on long-range guidance, based on utilization of all available information about the individual, gathered over a period of years, it seems likely that cumulative data would be of great help in college admission problems. However, relatively little use has been made of the total pool of such data for an individual in

predicting college success or in other practical problems of admissions screening. Increased use of this sort of information might be encouraged if more specific information were available regarding the relative usefulness and efficiency of the various kinds of information likely to be found in a typical cumulative record containing various kinds of data covering the secondary school period of the student's academic career.

An exceptional opportunity to investigate the possible uses of cumulative record data in predicting college success was afforded by data accumulated in considerable volume by the Educational Records Bureau and the National Registration Office for Independent Schools. This material consists of the records of test scores of pupils in member schools participating in the regular programs of the Educational Records Bureau, and the records of high school and college grades contained in the files of the National Registration Office. These data, representing the type of information generally to be found on an individual pupil's cumulative record card and transcripts, made possible a study based on pupils from a number of different schools and an even larger number of colleges.

Because of its interest in the problems of college admissions and in the general area of the prediction of success in college work, the College Entrance Examination Board requested the Educational Records Bureau to carry out such a study, and provided financial support for the project.

Nature of the Records

The records in the National Registration Office are in the form of individual data sheets for each pupil in the participating schools. These sheets furnished the following information which was utilized in the present study: student's rank in class and the number of students in the senior class; college attended; scores on the CEEB Scholastic Aptitude Test and on any CEEB achievement tests taken; school marks for each secondary school year,

from grade 9 through grade 12, in each subject studied; and freshman-year college marks in each subject studied.

The records contained in the files of the Educational Records Bureau are reports of pupil scores obtained in the regular fall and spring testing programs conducted by the Bureau. The fall programs feature aptitude and reading tests, and the spring programs stress achievement tests in specific subject matter fields. Scores are reported in terms of the raw or standard scores provided by the test publishers, and also in the form of independent school percentiles, derived from the cumulative results for any given form of a particular test during the period of its use in a Bureau program.

A check of the schools participating in both the National Registration Office and the Educational Records Bureau programs revealed that six independent schools and two public schools had fairly complete records, including both course marks and results on aptitude and achievement testing. The classes graduated from the secondary schools in 1955, in 1956, and in 1957 were selected for study. The inclusion of the members of at least three graduating classes was necessary in order to have a reasonably substantial number of cases, and the class of 1957 was the most recent class for which college grades could be obtained in time for use in the study. Although the total number of pupils in these groups was over a thousand, the records of fewer than half were finally used in the study. The attrition was caused partly by incompleteness of one kind or another in the individual records, and partly by the exclusion of pupils attending colleges other than those on a selected list. The basis for choosing the colleges is described in a later paragraph.

The individual records used were those of pupils who had attended the same school for all four secondary school years, so that there would be class marks for each pupil for each of the four years, earned in the same school. Additional

requirements for the inclusion of individual records were the availability of the following: scores on the CEEB Scholastic Aptitude Test; a school mark for at least one year in each of the five major subject areas; at least one standardized test score (from Bureau programs) in aptitude, one in reading, and one in achievement in each of the five subject areas - English, foreign language, social studies, mathematics, and science.

A different kind of consideration that led to further restriction of the available cases was found to be well worth while. In the early stages of the study, the project director received a preliminary copy of the report by B. S. Bloom and F. R. Peters entitled The Use of Academic Prediction Scales for Counselling and Selecting College Entrants, which was prepared for the National Council of Independent Schools and the National Registration Office for Independent Schools. This report deals with the development of several methods of adjusting school and college marks from different institutions in order to increase efficiency in predicting achievement in college work. The problem of adjusting to a common scale the grades from different institutions (both school and college) had been considered in the early planning of the present study, and one or two methods had been tentatively considered. But the results obtained by Bloom and Peters through their methods were so promising that permission was requested to make use of their data in assigning adjusted values to the school and college marks. When Dr. Bloom very kindly agreed to provide the necessary information for this, it was decided to use only the records for pupils who had enrolled in colleges for which he had data. This restriction reduced the number of available cases somewhat, but probably no more than would have been required by any other method of determining adjustments for college grades. The final count of cases was 445, distributed as shown in Table 1.

Table 1

Types of School and Number of Pupil Records Used from Each

	Boys	Girls	Total
Small groups from each of four independent schools, combined in the statistical analysis	20	32	52
An independent school for boys	76	--	76
A coeducational independent school	23	18	41
Total independent school pupils	119	50	169
Suburban public school A	24	31	55
Suburban public school B	120	101	221
Total public school pupils	144	132	276
Grand Total	263	182	445

The amount of secondary school test data was somewhat more extensive for the independent schools than for the public schools. Practically all the independent school pupils had academic aptitude scores for each of the four years. In almost all cases, these were scores on the ACE Psychological Examination, but a few ninth grade results consisted of scores on the Secondary Education Board Junior Scholastic Aptitude Test. All the independent school pupils had reading test scores for each of the four years. In most cases, these were scores from a fall administration of either the Iowa Silent Reading Test or the Diagnostic Reading Test, Survey Section. Where pupils had not taken either of these two tests, the scores on the Reading Comprehension part of the Cooperative English Test (taken in the spring) were used as reading measures.

For the two public schools, test results in academic aptitude from Educational Records Bureau fall testing programs were available for only two grades: either grades 10 and 12, or grades 11 and 12. For one public school, reading test results from fall testing were available for grades 9 and 11; for the other public school, spring results on the Cooperative Reading Comprehension Test were available in each of the four grades.

For the subject matter achievement tests, there was less difference between the independent schools and the public schools in the amount of test data available. Results on the Cooperative English Test for each of the four years were on file for all the schools. For all the independent schools, and for one of the two public schools, scores were on hand for at least three or four different achievement tests in each of the four high school years. In the other public school, most pupils had only one other test score, in addition to English, in one or two of the years, with two (or occasionally three) additional test scores in the other years.

Procedure

The general procedure for the study was to assemble the available data for the 445 pupils, in the form of 71 variables, for processing by an IBM computer. All school and college grades were recorded in terms of the scale used by the National Registration Office: 4, 3, 2, 1, and 0 corresponding (with minor variations) to the letter grades A, B, C, D, and F. Adjusted grades, both school and college, were included as additional variables. These adjusted grades were computed by Dr. Bloom, in accordance with the "Internal Method" described in his study,[1] and were based on the conversion scales developed in that project. All high school test results were recorded in terms of independent school percentiles, as provided by the Educational Records Bureau's regular fall

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1. Bloom and Peters: The Use of Academic Prediction Scales for Counselling and Selecting College Entrants, Chapter 2, pages 3e-12.

and spring testing programs. It was recognized that the use of percentiles in statistical computations of the kind here involved is not a typical procedure; but the use of test results in this form made it possible to combine results of tests in different fields and at different levels of study.

Intercorrelations among the different variables were obtained by means of IBM data processing equipment. The correlations of the various predictor variables with each of the two criterion variables - average freshman college grade, unadjusted and adjusted - were expected to yield information on the forecasting efficiency and comparative value of the different single predictors. The intercorrelations among the predictor variables could then be used in computing multiple correlations for various combinations of predictors, if such combinations appeared to be useful. In order to investigate possible differences among the various groups of pupils, separate correlations were obtained for each of the groups and subgroups specified in Table 1. The size of each of those groups is indicated in the last column of that table.

The primary set of measures included in the correlations consisted of the following:

1. The criterion measure, unadjusted: average college freshman grade
2. The criterion measure, adjusted: average college freshman grade, converted according to Dr. Bloom's scale for each of the colleges represented
3. Rank in high school class
4. Rank in high school class, converted to percent of total class
5. Score on Verbal part of CEEB Scholastic Aptitude Test
6. Score on Mathematical part of CEEB Scholastic Aptitude Test
7. Average high school mark in English (all four years)
8. Average high school mark in foreign languages (for however many years studied)
9. Average high school mark in social studies (for however many years studied)
10. Average high school mark in mathematics (for however many years studied)
11. Average high school mark in science (for however many years studied)
12. Tenth grade cumulative average high school mark, all subjects (grade 9 plus grade 10)

13. Eleventh grade cumulative average high school mark, all subjects (grade 9 plus grade 10 plus grade 11)
14. Four-year average high school mark, all subjects
15-22. Same as 7-14, respectively, but adjusted according to the school attended
23. Average English test percentile (all four years)
24. Average foreign language test percentile (for however many years tested)
25. Average social studies test percentile (for however many years tested)
26. Average mathematics test percentile (for however many years tested)
27. Average science test percentile (for however many years tested)
28. Tenth grade cumulative average achievement test percentile, all subjects (grade 9 plus grade 10)
29. Eleventh grade cumulative average achievement test percentile, all subjects (grade 9 plus grade 10 plus grade 11)
30. Four-year average achievement test percentile, all subjects
31. Tenth grade cumulative average academic aptitude test percentile (grade 9 plus grade 10)
32. Eleventh grade cumulative average academic aptitude test percentile (grade 9 plus grade 10 plus grade 11)
33. Four-year average academic aptitude test percentile
34. Tenth grade cumulative average reading test percentile (grade 9 plus grade 10)
35. Eleventh grade cumulative average reading test percentile (grade 9 plus grade 10 plus grade 11)
36. Four-year average reading test percentile
37. A rough index of "growth," consisting of the differences between the average achievement test percentile in the twelfth grade and in the ninth grade
38. A rough index of under- or over-achievement, consisting of the difference between the four-year average achievement test percentile and the four-year average aptitude test percentile
39. A rough index of inter-subject variability, consisting of the difference between the individual's highest and his lowest average test percentile, among the five subject areas

In addition to these primary measures, provision was made for comparisons among measures obtained in single grades by including the following variables in a separate correlation matrix:

1-6. Same as 1-6 in the primary set
7. Average high school mark in all subjects, for grade 9
8. Average high school mark in all subjects, for grade 10
9. Average high school mark in all subjects, for grade 11
10. Average high school mark in all subjects, for grade 12
11. High school mark in English in grade 9
12. High school mark in English in grade 10
13. High school mark in English in grade 11
14. High school mark in English in grade 12

15-22. Same as 7-14, respectively, but adjusted according to school attended
23. Academic aptitude test percentile in grade 9
24. Academic aptitude test percentile in grade 10
25. Academic aptitude test percentile in grade 11
26. Academic aptitude test percentile in grade 12
27. Reading test percentile in grade 9
28. Reading test percentile in grade 10
29. Reading test percentile in grade 11
30. Reading test percentile in grade 12
31. Average achievement test percentile in grade 9 (excluding reading)
32. Average achievement test percentile in grade 10 (excluding reading)
33. Average achievement test percentile in grade 11 (excluding reading)
34. Average achievement test percentile in grade 12 (excluding reading)
35. English test percentile in grade 9
36. English test percentile in grade 10
37. English test percentile in grade 11
38. English test percentile in grade 12

Supplementary analyses involved the computation of additional correlations of selected variables for separate groups of pupils, divided according to sex and according to type of college attended.

The adjusted college grades (variable 2) and the adjusted high school grades (as used for variables 15-22 in each of the two sets) were obtained from Dr. Bloom. The method used in preparing the adjustment scales is described in detail in the Bloom and Peters report referred to above. This method, designated the "Internal Method" by the authors, utilized National Registration Office data on school and college grades of a large number of pupils from various schools and colleges. The procedure consisted of the following steps:

Step 1: The colleges in the sample were divided into three groups, as follows: Type I, colleges where, on the average, students received higher grades than they had received in secondary school. Type II, colleges where, on the average, students received about the same grades as they had received in secondary school. Type III, colleges where, on the average, students received lower grades than they had received in secondary school.

Step 2: The correlations between secondary school and college grades were found for each of the three types of college. Then, the regression of secondary

school grades on college grades was utilized to provide a way of modifying the college grades in each type of college, to take into consideration the differences among the college types.

Step 3: The modified college grade, as determined in Step 2, was substituted for the actual college grade of each student, in accordance with the type of college attended.

Step 4: The records were then separated on the basis of the secondary school attended. For each secondary school, the correlation between secondary school grade and modified college grade was computed. The regression of modified college grade on secondary school grade was then applied, separately for each school, to determine new values for the school grades. These modified values were substituted for the original school grades.

Step 5: The records were next separated on the basis of the particular college attended, and a similar process carried out to determine modified grade values for each college, on the basis of the regression of modified school grade on actual college grade in the individual college.

The modified school grade values obtained in Step 4, and the modified college grade values obtained in Step 5 constitute the "adjusted school grade" and the "adjusted college grade" used as variables in the present study.

Results

Effects of Conversion to Adjusted Class Marks

Since two criterion variables were included in the study - the uncorrected average college grade for the freshman year, and the average grade adjusted according to the particular college involved - a comparison of the correlations obtained with the two types of criterion is of interest. Table 2 shows the range and median for each of four sets of correlations: high school marks with uncorrected criterion; the same marks with the adjusted criterion; test scores with the uncorrected criterion; and the same scores with the adjusted criterion.

Table 2

Correlations of Marks and Test Scores with Unadjusted Criterion, Compared with Correlations with Adjusted Criterion

Independent School Pupils (N = 169)

	Unadjusted H.S. Marks (16 Correlations)		Test Scores (32 Correlations)	
	Range	Median	Range	Median
Correlations with Unadjusted Criterion	.31 to .52	.43	.28 to .50	.35
Correlations with Adjusted Criterion	.49 to .72	.63	.44 to .70	.54
Differences Between Correlation with Adjusted Criterion and Correlation with Unadjusted Criterion	.13 to .25	.21	.12 to .26	.20

Public School Pupils (N = 276)

	Unadjusted H.S. Marks (16 Correlations)		Test Scores (24 Correlations)	
	Range	Median	Range	Median
Correlations with Unadjusted Criterion	.41 to .53	.47	.15 to .40	.34
Correlations with Adjusted Criterion	.62 to .75	.68	.34 to .67	.56
Differences Between Correlation with Adjusted Criterion and Correlation with Unadjusted Criterion	.17 to .24	.21	.15 to .27	.23

Total Cases (N = 445)

	Unadjusted H.S. Marks (16 Correlations)		Test Scores (24 Correlations)	
	Range	Median	Range	Median
Correlations with Unadjusted Criterion	.42 to .53	.49	.20 to .46	.37
Correlations with Adjusted Criterion	.60 to .75	.66	.37 to .70	.57
Differences Between Correlation with Adjusted Criterion and Correlation with Unadjusted Criterion	.16 to .23	.20	.12 to .25	.22

The various school marks and test scores involved in these correlations include marks or scores for single years and single subjects, and also various averages of marks or scores.

One would have expected the high school marks to have higher correlations with the adjusted criterion than with the unadjusted criterion, since the adjustments applied to the college grades were specifically designed to produce this result. Not only did this prove to be true, but the correlations of high school rank and of all test scores with the adjusted criterion were also higher than those with the unadjusted criterion, and the difference was just about as great for test scores as it was for school marks.

Without exception, the correlations of high school grades or test scores (either single grades or scores, or various averages of grades or scores) were increased by using the adjusted college average grade, instead of the uncorrected grade, as the criterion measure. The increase was in no case less than .12, and sometimes was as much as .27. The median increase was around .20.

Adjustment of the high school grades did not affect the correlations as much as did the adjustment of the college grades. This, of course, was to be expected. The assortment of colleges included in the sample was quite extensive, consisting of 66 different institutions of various types; one would therefore expect that a procedure for putting the grades from all these colleges on a common scale would have a pronounced effect on the correlations. In the case of the high school grades, however, the number of different schools was not large, and the differences in general character among them were probably much less extensive than the differences among the numerous colleges included. The use of adjusted high school grades instead of the uncorrected grades did produce increases in the correlations, with only a few exceptions; but the increases were small, ranging from .01 up to .05. Table 3 summarizes the relations between the two sets of correlations.

Table 3

Correlations of Unadjusted High School Marks with Criterion,
Compared with Correlations of Adjusted High School Marks with Criterion

	16 Correlations with Adjusted Criterion					
	Independent School Pupils (N = 169)		Public School Pupils (N = 276)		Total Cases (N = 445)	
	Range	Median	Range	Median	Range	Median
Correlations of Unadjusted High School Marks	.49 to .72	.63	.62 to .75	.68	.60 to .75	.66
Correlations of Adjusted High School Marks	.47 to .73	.64	.64 to .78	.70	.60 to .76	.69
Differences Between Correlation of Adjusted H.S. Marks and Correlation of Unadjusted H.S. Marks	-.02 to .04	.02	-.01 to .05	.02	.00 to .04	.02

Predictive Value of Various Achievement Measures

An indication of the general magnitude of the correlations obtained is given in Tables 2 and 3. Correlations of specific measures of achievement with the criterion are presented in Table 4. The correlations for course marks (adjusted) and for test scores of comparable scope are listed in parallel columns to facilitate comparison. The criterion is the adjusted average freshman grade in college.

In nearly all cases, course marks are somewhat more closely related to the criterion than are the test scores. A conspicuous exception is in the area of foreign languages for the independent schools. The average test percentile gives a considerably higher correlation with the adjusted college grade than does the average mark; in fact, the average foreign language test percentile is nearly as good a predictor as the overall average test percentile for all subjects.

Table 4

Correlations of Various Achievement Measures with Adjusted College Freshman Average Grade

	Independent School Pupils (N = 169) Correlation with Criterion of:		Public School Pupils (N = 276) Correlation with Criterion of:		Total Cases (N = 445) Correlation with Criterion of:	
Averages for 4 years	Adjusted H.S. Mark	Achievement Test %ile	Adjusted H.S. Mark	Achievement Test %ile	Adjusted H.S. Mark	Achievement Test %ile
English	.65	.59	.74	.62	.72	.61
Foreign Language	.63	.69	.71	.64	.68	.67
Social Studies	.69	.51	.68	.40	.70	.48
Mathematics	.58	.54	.64	.48	.64	.53
Science	.63	.57	.67	.47	.67	.53
Average, all subjects	.73	.70	.78	.67	.76	.70
All Subject Averages, Grade by Grade						
Grade 9	.59	.62	.70	.55	.68	.59
Grade 10	.68	.68	.72	.64	.71	.68
Grade 11	.69	.67	.72	.62	.71	.65
Grade 12	.69	.69	.73	.56	.72	.63
English, Grade by Grade						
Grade 9	.47	.56	.65	.56	.60	.56
Grade 10	.59	.56	.65	.57	.64	.57
Grade 11	.58	.56	.67	.56	.65	.57
Grade 12	.63	.56	.68	.57	.67	.58

The test results also give higher correlations than do the course marks in the ninth grade records for the independent schools, for both English and for the general average for the grade. The overall average, for all subjects in all grades, is only slightly higher for marks than for test results in the case of the independent schools: .73 as compared with .70; but the difference in favor of marks is greater in the case of the public schools: .78 as compared with .67.

For the public school that furnished the great majority of the public school pupils (221 out of the total of 276), the correlation of average mark with the adjusted criterion was .82. The relationship of high school marks to the criterion was considerably lower in the other public school, the correlation being only .60. The number of pupils contributed by that school was not large (55), not only because the school has a smaller enrollment than the first school, but also because only two graduating classes could be drawn on, since test data were not available for one of the classes.

The correlation of .73 for average school mark vs. criterion in the total independent school group is exceeded by the figures for the subdivisions within that group. The correlations for the three sections of the independent school group, taken separately (the first combining small groups from four schools, and the other two representing single schools), were .79, .81, and .80, respectively.

In the independent schools, the social studies marks are somewhat more closely associated with the criterion than are the marks in other areas. In contrast to this result, the public school mark in social studies ranks below the English and foreign language marks as a predictor. In the public school results, the four-year average English mark gives the best prediction of the single-subject measures.

The results for separate grades appear to indicate that, when measures for any single grade are considered as predictors of college achievement, no one

grade shows a distinct superiority over any other. It is worth noting that the tenth grade correlations tend to be near or above those of the twelfth grade. Combinations of measures for more than one grade are consistently better than single-grade measures, however, according to the data in Table 5.

Table 5

Correlations of Various Cumulative Averages (All Subjects) of School Marks and Achievement Test Percentiles with Adjusted Criterion

	Independent School Pupils (N = 169)		Public School Pupils (N = 276)		Total Cases (N = 445)	
	Adjusted H.S. Mark	Achievement Test %ile	Adjusted H.S. Mark	Achievement Test %ile	Adjusted H.S. Mark	Achievement Test %ile
Grade 9 alone	.59	.62	.70	.55	.68	.59
Grades 9+10	.68	.67	.75	.64	.73	.67
Grades 9+10+11	.71	.69	.76	.67	.75	.69
Grades 9+10+11+12	.73	.70	.78	.67	.76	.70
Grade 12 alone	.69	.69	.73	.56	.72	.63
Grades 11+12	.73	.70	.76	.66	.75	.69
Grades 10+11+12	.74	.71	.78	.68	.76	.71
Grades 9+10+11+12	.73	.70	.78	.67	.76	.70

For both average mark and average achievement test result, the correlation with the criterion increases as the average covers more years, working forward from grade 9. The increase is fairly substantial when the averages for the first two secondary school years are compared with the measures for grade 9 alone; but the advantage, as predictors, of eleventh grade cumulative averages over the tenth grade, and of twelfth grade cumulative averages over eleventh grade, is considerably smaller, the average difference being about .02.

The lower half of Table 5 shows the results for various cumulative averages, working backward from grade 12. Again, the correlations for averages covering two or more years are somewhat higher than those for a single grade (in this case, grade 12); but the differences among the correlations for two-year, three-year, and four-year averages are very slight.

The correlations for the CEEB achievement tests were based on smaller numbers of cases than the other correlations, since not all pupils took the achievement tests, and, for those who did, there were all sorts of combinations of subjects. However, sets of intercorrelations, covering the particular subject test, the criterion, and the two CEEB Scholastic Aptitude Test scores, were computed separately for the various groups of pupils having scores on each of the following CEEB achievement tests: English, French, Social Studies, Advanced Mathematics, and Physics. The correlations of the achievement tests with the criterion are shown in Table 6. Although the two sets of correlations are not based on identical groups of students, the correlations with the criterion of the four-year test averages in the various fields, obtained in the regular ERB testing programs, are listed alongside the corresponding correlations of the CEEB achievement test results.

Table 6

Correlations of CEEB Achievement Test Scores and of Achievement Test Averages from ERB Programs with Adjusted Criterion

	Independent School Pupils			Public School Pupils			Total Cases		
	CEEB Achievement Tests		ERB Program Tests (N=169)	CEEB Achievement Tests		ERB Program Tests (N=276)	CEEB Achievement Tests		ERB Program Tests (N=445)
	N	r	r	N	r	r	N	r	r
English	127	.59	.59	180	.50	.62	307	.54	.61
Foreign Language (CEEB, French only)	53	.57	.69	96	.51	.64	149	.53	.67
Social Studies	52	.68	.51	122	.55	.40	174	.62	.48
Mathematics	62	.60	.54	56	.35	.48	118	.48	.53
Science (CEEB, Physics only)	15	.32	.57	52	.51	.47	67	.48	.53
Average, All Tests Taken	132	.65	.70	185	.61	.67	317	.63	.70

In some cases, the CEEB results furnish the better predictor; in others, the ERB program testing results are better. No clear-cut indications were obtained because of the greatly varying numbers of pupils involved, and because the number of test scores included in the different ERB averages also varied.

Correlations with the adjusted criterion were also computed for the average of whatever CEEB achievement tests a given pupil had taken. For the 132 independent school pupils who took one or more CEEB achievement tests, the correlation is .65. For the 185 public school pupils with one or more CEEB achievement test scores, the correlation is .61. These figures compare with correlations of .70 for the total group of 169 independent school pupils, and .67 for the total group of 276 public school pupils, for overall averages of all the achievement tests taken, in the regular course of program testing, in all four grades. For the total group of pupils, the ERB achievement test average yielded the higher correlation with the criterion - .70 as compared with .63 for the CEEB achievement test average.

Correlations of Aptitude and Reading Test Results with the Criterion

Table 7 gives the correlations with the adjusted criterion of the aptitude and reading test results. In the case of correlations for cumulative averages, results are available for the independent school group only, since the majority of the public school pupils took these tests in only two grades. However, results for an average of the two grades represented in the public schools are also shown for the aptitude test results. Reading test results are not given for the public school pupils because of differences between the two public schools in the grades represented in the reading averages.

In both the independent and the public schools, reading tests and aptitude tests showed closely similar correlations with the criterion. These correlations fell within the range of .46 to .52 in each of the four grades.

Table 7

Correlations of Aptitude and Reading Test Results with Adjusted Criterion

	Aptitude Test Percentiles		Reading Test Percentiles	
	Independent School Pupils (N = 169)	Public School Pupils (N = 276)	Independent School Pupils (N = 169)	Public School Pupils (N = 276)
Grade 9	.52		.50	.47
Grade 10	.48	.46	.50	
Grade 11	.50		.50	.49
Grade 12	.50	.46	.50	
Grades 9+10	.52		.53	
Grades 9+10+11	.53		.54	
Grades 9+10+11+12	.53		.54	
Grades 11+12	.52		.52	
Grades 10+11+12	.52		.53	
Grades 10+12		.48		

When cumulative or combined averages for two to four grades were used, the range of correlations was just slightly higher - .48 to .54. In general, these aptitude and reading test correlations are consistently lower than the correlations yielded by the achievement test averages for any one grade. As was shown in Table 4, the latter fell between .60 and .70 for independent schools, and between .55 and .65 for public schools.

The intercorrelations among aptitude, reading, and achievement test scores are so high that the addition of aptitude or reading test results to the achievement test scores produces very little improvement in the correlation with the criterion. Most of the intercorrelations among the various types of test results are close to .80, some going as high as .85. For example, if the average aptitude test percentile (four-year average for independent schools, two-year average for public schools) is combined with the four-year average of achievement test percentiles in all subjects, the resulting multiple correlation with the criterion

is .71 for independent schools, .68 for public schools, and .71 for the total group. These three multiple correlations compare with .70, .67, and .70, respectively, for four-year achievement test averages alone. The increase produced by adding the four-year average of reading test percentiles to the four-year average of achievement test percentiles (for independent schools) is also small, the resulting multiple correlation being .71, as compared with .70 for the achievement test average alone.

Nearly all the aptitude test scores referred to in Table 7 were percentiles derived from total scores on the ACE Psychological Examination.[1] The correlations given in that table, based on a total test score covering both verbal and mathematical material, fall somewhere between the correlations obtained for the verbal part of the CEEB Scholastic Aptitude Test and the correlations for the mathematical part of that test. The latter correlations are presented in Table 8. Also shown in Table 8 are the correlations with the criterion of the part scores (L-scores and Q-scores) on the ACE Psychological Examination for grade 12, and in the case of the independent schools, for the four-year average as well.

Table 8

Correlations of the CEEB Scholastic Aptitude Test, Verbal and Mathematical Scores, and the ACE Psychological Examination, L- and Q-Scores, with Adjusted Criterion

	Independent School Pupils (N = 169)	Public School Pupils (N = 276)	Total Cases (N = 445)
CEEB Verbal Score	.60	.61	.62
CEEB Mathematical Score	.44	.34	.37
ACE, Grade 12, L-Score	.51	.50	.50
ACE, Grade 12, Q-Score	.27	.29	.25
ACE, 4-yr. Ave., L-Score	.53		
ACE, 4-yr. Ave., Q-Score	.34		

1. A few pupils took the Junior Scholastic Aptitude Test in the ninth grade; for these pupils, the verbal and numerical percentiles were averaged to furnish a total aptitude score for grade 9.

The correlations with the adjusted criterion of the CEEB Scholastic Aptitude Test (taken in the senior year, in most cases) are substantially higher than the correlations for the grade 12 ACE results. Although the correlations of the four-year averages for both part scores on the ACE are a little higher than those for the grade 12 results alone, they still do not reach the level of the CEEB correlations. In the case of both the CEEB and the ACE aptitude tests, the verbal score is considerably better than the mathematical score as a predictor of average college achievement.

Correlations of Other Measures with the Criterion

In addition to the data on test scores and school marks reported thus far, several additional measures of a different kind were included in the correlations. The most important of these is the rank in class. Correlations were obtained for both the ordinal rank (ignoring the size of the class), and for the rank, expressed as a percent of the total class. These correlations are shown in Table 9.

Table 9

Correlations of Rank in Class with Adjusted Criterion

	Independent School Pupils N = 169)	Public School Pupils N = 276)	Total Cases (N = 445)
Correlation of Ordinal Rank with Adjusted Criterion	.64	.72	.39
Correlation of Percentage Rank with Adjusted Criterion	.72	.77	.76

As one might expect, the correlation of rank in class with the criterion is higher when the size of class is taken into account. The difference between the correlations for the ordinal and for the percentage rank is not great for the public school group, but this may be attributed to the fact that only two schools were involved, and one of the two provided a rather large proportion of the

public school pupils in this sample. The difference is a little larger in the independent school group, where more different schools were included; but within this group, the variation in size of class is still much less than when the total group is considered. In the combined group, where the greatest range in size of class naturally occurs, the difference between the two correlations is quite large.

Table 10 shows the correlations of the rank in class (corrected for size of class) with overall average grade (both adjusted and unadjusted) and with overall average achievement test result. These correlations are highest for the public school group. Apparently the rank in class in these schools is determined primarily by the average grade, although rank is also closely related to achievement test average. In the independent schools, the correlation with

Table 10

Correlations of Percentage Rank in Class with Average Mark and with Average Achievement Test Percentile

	Independent School Pupils (N = 169)	Public School Pupils (N = 276)	Total Cases (N = 445)
Correlation with Adjusted Four-Year Average Mark	.71	.95	.83
Correlation with Unadjusted Four-Year Average Mark	.77	.94	.86
Correlation with Four-Year Average Achievement Test Percentile	.58	.84	.74

grades is considerably lower than in the public school group. It may be that the independent school pupil's rank in his class is influenced by some factor other than his average grade alone; or perhaps some of the independent schools determine class rank on the basis of average grade in all subjects, while other schools determine the rank from average grade in academic subjects alone.

The other measures included in the correlations were the results of some rather sketchy efforts to provide, without an excessive amount of clerical work, rough indices of growth, of under- or over-achievement, and of variability from subject to subject. The index of growth consisted of the difference between the average achievement test percentile in the twelfth grade and in the ninth grade. The index of under- or over-achievement was the difference between the four-year average achievement test percentile and the four-year (or for public schools, the two-year) average aptitude test percentile. The variability index consisted of the difference between the individual's highest and lowest average test percentiles, among the five subject areas. Table 11 gives the correlations with the criterion obtained for those indices.

Table 11

Correlations of Measures of Growth, of Under- or Over-Achievement, and of Inter-Subject Variability with Adjusted Criterion

	Independent School Pupils (N = 169)	Public School Pupils (N = 276)	Total Cases (N = 445)
Measure of Growth	.00	-.13	-.03
Measure of Under- or Over-Achievement	.05	.01	.08
Measure of Inter-Subject Variability	-.33	-.42	-.36

Of these three measures, only the variability measure shows much relation to the criterion. There seems to be some tendency for the less variable students to do better in college. It is possible that the negative correlation obtained is due at least in part to the fact that the students with generally high achievement (in both school and college) had less room to vary, from subject to subject, than did the students with generally lower achievement. The average achievement test percentiles for the pupils in the group studied here are above the independent

school median in all areas except foreign languages, and range clear up to a percentile of 80 on social studies tests for the public school group. This general level would tend to reduce the likelihood of variation for the better students, while leaving the poorer students in the group free to vary over a wider range.

Separate Results for Boys and Girls

In addition to the major analyses described above, correlations between the more important variables were computed separately for boys and girls, and also for groups separated according to type of college attended. Tables 12 and 13 show the correlations between the criterion and certain achievement measures, for boys and for girls.

Table 12

Correlations of Various Adjusted Four-Year Average High School Marks with Adjusted Criterion, Computed Separately for Boys and for Girls

	Independent School Pupils		Public School Pupils		Total Cases	
Four-Year Average Mark in:	Boys N=119	Girls N=50	Boys N=144	Girls N=132	Boys N=263	Girls N=182
English	.73	.57	.75	.69	.74	.67
Foreign Language	.65	.62	.70	.67	.66	.67
Social Studies	.70	.66	.69	.66	.69	.68
Mathematics	.64	.45	.69	.62	.66	.61
Science	.67	.53	.69	.63	.67	.62
Average, All Subjects	.76	.72	.80	.74	.75	.75

In the case of the high school marks, the correlations are almost without exception higher for boys than for girls. The opposite is the case with respect to the achievement and aptitude test percentiles: in seventeen out of the twenty pairs of correlations shown in Table 13, the figure is higher for girls than for boys. It is also interesting to see that for the girls, the average achievement test percentiles predict the adjusted criterion almost as well as the average high school marks.

Table 13

Correlations of Various Four-Year Average Test Percentiles with Adjusted Criterion, Computed Separately for Boys and for Girls

	Independent School Pupils		Public School Pupils		Total Cases	
Four-Year Average Achievement Test Percentile in:	Boys N=119	Girls N=50	Boys N=144	Girls N=132	Boys N=263	Girls N=182
English	.58	.62	.58	.63	.58	.64
Foreign Language	.70	.66	.61	.62	.65	.65
Social Studies	.50	.60	.43	.52	.46	.59
Mathematics	.58	.63	.49	.60	.54	.64
Science	.60	.59	.51	.54	.56	.58
Average, All Subjects	.70	.73	.65	.71	.68	.74
Four-Year Average Aptitude Test Percentile	.55	.56				
Four-Year Average Reading Test Percentile	.54	.56				

The relation between the correlations for boys and for girls is the same for the CEEB Scholastic Aptitude scores as for the other test results: the correlations are higher for girls than for boys, as is shown in Table 14.

Table 14

Correlations of CEEB Scholastic Aptitude Test Scores with Adjusted Criterion, Computed Separately for Boys and for Girls

	Independent School Pupils		Public School Pupils		Total Cases	
	Boys N=119	Girls N=50	Boys N=144	Girls N=132	Boys N=263	Girls N=182
CEEB Verbal Score	.59	.66	.59	.65	.60	.67
CEEB Mathematical Score	.53	.58	.48	.53	.51	.56

Separate Results for Types of College

Correlations between the criteria and the major predictor variables were also computed separately by type of college. In connection with these separate figures for types of college, one question that might be raised is whether the use of the adjusted college grade as a criterion has much advantage over the uncorrected grades when one is dealing with a number of colleges of the same type. Table 15 gives a summary of correlations using the adjusted and the unadjusted criteria, and the differences between the pairs of correlations.

Table 15

Correlations of Seventeen High School Measures with Unadjusted Criterion, Compared with Their Correlations with Adjusted Criterion, Computed Separately for Type of College

Type of College	No. of Colleges	No. of Students	Correlations with Unadjusted Criterion		Correlations with Adjusted Criterion		Differences between Correlations with Adjusted Criterion and with Unadjusted Criterion	
			Range	Median	Range	Median	Range	Median
1. "Ivy League," Men	5	87	.25 to .69	.49	.29 to .78	.55	.02 to .10	.06
2. "Big Seven," Women	5	53	.21 to .68	.49	.23 to .69	.48	-.14 to .08	.01
3. "Ivy League," Coed.	2	39	.15 to .79	.54	.01 to .74	.41	-.16 to -.01	-.09
4. Junior Coll., Women	6	22	-.06 to .52	.26	-.10 to .51	.20	-.27 to .09	-.07
5. Other Private Coll., Men	10	65	.32 to .66	.49	.50 to .81	.71	.05 to .24	.16
6. Other Private Coll., Women	10	55	.27 to .64	.45	.32 to .64	.49	-.08 to .11	.04
7. Other Private Coll., Coed.	21	97	.24 to .64	.42	.36 to .75	.63	.09 to .28	.20
8. State Colleges	7	27	-.08 to .40	.26	-.05 to .61	.37	-.06 to .21	.11

The results shown in Table 15 are about what might be expected. For Type 1 and Type 2 colleges, where each group of five colleges is probably quite homogeneous, the median increase in correlation produced by using the adjusted college grade as criterion is quite small. In Types 5 and 7, however, with 10 and 21 colleges, respectively, more variation in grading standards seems to be indicated, and much larger gains in correlation are shown. The median difference between correlations with adjusted and with unadjusted criteria is .16 for Type 5 and .20 for Type 7. Although Type 6 includes as many colleges as Type 5, the differences in correlations are much smaller. The numbers of students in Types 3, 4, and 8 are too small for the results to be very meaningful.

Table 16 lists the variables that produced the five highest correlations with the adjusted criterion, within each type of college, and gives the figures for those correlations. For every group except Type 4 (which includes only 22 students), the overall average high school mark (adjusted) appears in the top five correlations for the group, and in all groups except Types 4 and 6, the percentage rank in class is also among the five highest. In most of the groups, average high school marks in individual subjects, particularly in English and in social studies, are also found among the variables yielding the five highest correlations - in one or two instances producing a higher correlation with the criterion than does the overall average mark or the rank in class.

Table 16

Variables Yielding the Five Highest Correlations with the Adjusted Criterion for Each Type of College

Type of College	No. of Colleges	No. of Students	Name of Variable	Correlation with Adjusted Criterion
1. "Ivy League," Men	5	87	Percentage rank in class	.78
			Ave. H.S. mark (adjusted)	.70
			Ave. English mark (adjusted)	.69
			Ave. Soc. Stud. mark (adj.)	.67
			Ave. Achievement test %ile	.62
2. "Big Seven," Woman	5	53	Ave. Soc. Stud. mark (adj.)	.69
			Percentage rank in class	.68
			Ave. H.S. mark (adjusted)	.64
			Ave. Science mark (adjusted)	.58
			Ave. For. Lang. mark (adj.)	.56
3. "Ivy League," Coed.	2	39	Percentage rank in class	.74
			Ave. English mark (adjusted)	.68
			Ave. For. Lang. mark (adj.)	.65
			Ave. H.S. mark (adjusted)	.58
			Ave. Soc. St. mark, ave. For. Lang. test %ile (tied)	.57
4. Junior Coll., Women	6	22	Ave. Math. test %ile	.51
			Ave. Achievement test %ile	.43
			Ave. English test %ile	.28
			CEEB SAT Math. score	.27
			Ave. Soc. Stud. test %ile	.23
5. Other Private Coll., Men	10	65	Ave. H.S. mark (adjusted)	.81
			Ave. English mark (adjusted)	.81
			Percentage rank in class	.79
			Ave. Science mark (adjusted)	.79
			Ave. Soc. Stud. mark (adj.)	.74
6. Other Private Coll., Women	10	55	Ave. H.S. mark (adjusted)	.64
			Ave. Reading test %ile	.61
			CEEB SAT Verbal score	.61
			Ave. Soc. Stud. mark (adj.)	.56
			Ave. Achievement Test %ile	.55
7. Other Private Coll., Coed.	21	97	Ave. H.S. mark (adjusted)	.75
			Percentage rank in class	.75
			Ave. Achievement test %ile	.71
			Ave. English mark (adjusted)	.71
			Ave. Math. mark (adjusted)	.70
8. State Colleges	7	27	Ave. For. Lang. mark (adj.)	.61
			Ave. H.S. mark (adjusted)	.59
			Ave. English mark (adjusted)	.51
			Percentage rank in class	.49
			Ave. For. Lang. test %ile	.46

Expectancy Tables for Predicting College Grades

The major presentation of the results of this study has been in terms of correlation coefficients indicating the relationships found between the various predictor variables and the criterion: college freshman grades. When it comes to practical application of some of the findings, perhaps a more direct way of making interpretations is provided by tables showing the odds that students at a given level on a particular high school measure will make one or another grade average as college freshmen. A number of such expectancy tables have therefore been prepared, and are presented as Tables 17 through 22. They are based on the grades and test scores obtained by the students in the total group of 445, with the exception of Table 22. In the latter case, ninth grade aptitude test results were available only for the group of independent school pupils; the figures in Table 22 are therefore based on results for the 169 students in that group.

In the first of these tables, Table 17, the figures given show the likelihood (in terms of chances out of a hundred) that a student will obtain a particular average grade as a freshman in college, if his average high school grade is known. The categories of college grades are labeled, first, as "Adjusted College Grade." These figures refer to the average of first-year college grades, adjusted by means of the conversions developed by Dr. Bloom[1] to take account of the particular college in which the grade was obtained. This "adjusted college grade" was the measure used as the adjusted criterion in the correlation studies. In addition to the numerical designations of these adjusted college grades, the corresponding letter grades in each of two selected colleges are shown, simply as an illustration of the effect of applying the conversion into adjusted grades to the marks from different institutions.

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1. See page 9 for a description of the conversion procedure.

In the same table, the high school average grades are similarly shown in terms of adjusted grade and also in terms of the corresponding letter grades given in two different schools, for illustrative purposes.

Table 17 is to be read as follows: A student whose four-year average mark in high school (converted into the "adjusted grade") is 3.0 or higher has five chances in a hundred of making an average college freshman grade of 2.5 to 2.7, in terms of the college "adjusted grade." He has 90 chances in a hundred of making an adjusted grade of 2.8 to 3.0 in college, and five chances in a hundred of making an adjusted grade of 3.1 or higher. Another student, with an adjusted high school grade in the range of 2.6 to 2.9, has 13 chances in a hundred of making an adjusted college grade of 2.2 to 2.4, 54 chances of making 2.5 to 2.7, 32 chances of making 2.8 to 3.0, and one chance in a hundred of making 3.1 or higher. The adjusted high school grade of this second student - between 2.6 and 2.9 - might represent a letter grade of B in one secondary school, or a letter grade of A in some other secondary school. Similarly, the adjusted college grade in the range of 2.5 to 2.7, for which this student has the greatest chance (54 out of 100), could correspond to a letter grade of C in one college, but might indicate a letter grade of B- in some other college.

The remaining tables, through Table 21, are to be read in similar fashion. All indicate the chances of making particular grades in college, given various secondary school data. Table 22 differs from the preceding ones in showing the chances of making various average achievement test percentiles in the twelfth grade, as judged by the ninth grade aptitude test results. This table is presented as an indication of the possibilities for predicting achievement test results in the last secondary school year on the basis of aptitude measured at the very beginning of the secondary school period.

Table 17

Chances in 100 of Attaining Indicated Average Freshman College Grade, Given a Student's Four-Year Average Grade in High School

Adjusted H.S. Grade	Original Grade in H.S. P	Original Grade in H.S. Q	Adjusted College Grade: / Original Grade in College X: / Original Grade in College Y:	2.1 or below / F / D	2.2 to 2.4 / D / C	2.5 to 2.7 / C / B-	2.8 to 3.0 / B / B+	3.1 or above / A / A
3.0 or above	A			--	--	5	90	5
2.6 to 2.9	B	A		--	13	54	32	1
2.1 to 2.5	C	B		7	49	38	6	--
2.0 or below	D or below	C or below		41	49	10	--	--

Example: A certain student in high school P has a four-year average grade of D. This average grade would be represented by an adjusted grade of 2.0. Such a student has ten chances in 100 of making a C average for his freshman year in college X, or of making a B- average in college Y.

Table 18

Chances in 100 of Attaining Indicated Average Freshman College Grade, Given a Student's Average High School Achievement Test Percentile

Four-Year Average High School Achievement Test %ile (Independent School Norms)	Adjusted College Grade:	2.1 or below	2.2 to 2.4	2.5 to 2.7	2.8 to 3.0	3.1 or above
	Original Grade in College X:	F	D	C	B	A
	Original Grade in College Y:	D	C	B-	B+	A
80 or above		--	3	32	63	2
60 to 79		1	25	50	23	1
40 to 59		10	42	41	7	--
20 to 39		23	59	18	--	--
19 or below		74	13	13	--	--

Example: A student with a four-year average percentile of 65 on achievement tests taken in high school has 50 chances in 100 of making a C average in college X for his freshman year.

Table 19

Chances in 100 of Attaining Indicated Average Freshman College Grade, Given a Student's High School Rank in Class

Rank in Class (Fifth of High School Class)	Adjusted College Grade: / Original Grade in College X: / Original Grade in College Y:	2.1 or below / F / D	2.2 to 2.4 / D / C	2.5 to 2.7 / C / B-	2.8 to 3.0 / B / B+	3.1 or above / A / A
Top Fifth		1	2	35	60	2
Second Fifth		1	30	55	14	--
Third Fifth		5	48	44	3	--
Fourth Fifth		22	59	19	--	--
Bottom Fifth		52	44	4	--	--

Example: A student ranking in the third fifth of his high school class has 44 chances in 100 of making a C average in college X for his freshman year.

Table 20

Chances in 100 of Attaining Indicated Average Freshman College Grade, Given a Student's Verbal Score on the CEEB Scholastic Aptitude Test

Score on Verbal Part of CEEB SAT	Adjusted College Grade:	2.1 or below	2.2 to 2.4	2.5 to 2.7	2.8 to 3.0	3.1 or above
	Original Grade in College X:	F	D	C	B	A
	Original Grade in College Y:	D	C	B-	B+	A
700 or above		--	3	17	73	7
620 to 699		1	6	55	37	1
540 to 619		4	31	41	24	--
460 to 539		6	43	41	10	--
380 to 459		30	51	17	2	--
379 or below		29	54	13	4	--

Example: A student with a verbal score on the SAT of 645 has 55 chances in 100 of making a B- average in college Y for his freshman year.

Table 21

Chances in 100 of Attaining Indicated Average Freshman College Grade, Given a Student's Mathematical Score on the CEEB Scholastic Aptitude Test

Score on Mathematical Part of CEEB SAT	Adjusted College Grade:	2.1 or below	2.2 to 2.4	2.5 to 2.7	2.8 to 3.0	3.1 or above
	Original Grade in College X:	F	D	C	B	A
	Original Grade in College Y:	D	C	B-	B+	A
700 or above		--	15	39	44	2
620 to 699		1	21	46	32	--
540 to 619		8	31	38	22	1
460 to 539		14	33	36	16	1
380 to 459		14	40	39	7	--
379 or below		19	69	12	--	--

Example: A student with a mathematical score on the SAT of 550 has 38 chances in 100 of making a B- average in college Y for his freshman year.

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Chances in 100 of Attaining Indicated Average Percentile on Grade 12 Achievement Tests, Given a Student's Aptitude Test Percentile in Grade 9
(Based on Results for Independent School Pupils Only)

%ile on Grade 9 Aptitude Test (Independent School Norms)	Average %ile on Grade 12 Achievement Tests: (Independent School Norms)	19 or below	20 to 39	40 to 59	60 to 79	80 or above
80 or above		--	--	6	47	47
60 to 79		--	18	32	38	12
40 to 59		--	18	37	42	3
20 to 39		2	38	42	18	--
19 or below		14	72	14	--	--

Example: A student with a percentile of 50 on the aptitude test administered in grade 9 has 37 chances in 100 of obtaining an average percentile between 40 and 59 on achievement tests administered in grade 12.

Summary

A number of important indications may be found in the results of this study. First of all, the data support the findings of many other studies in that the best single predictor of college freshman marks was the average high school mark. An especially high relationship was found for the public school group; the adjusted four-year average mark for all subjects gave a correlation of .78 with the adjusted criterion. For the one school that contributed most of the public school pupils, an even higher correlation was found: .82. A correlation of this size indicates that the predictive accuracy of the average mark, for this one school at least, is about as great as can be attained until there is an improvement in the criterion measure.

The correlation of adjusted average high school mark with the adjusted criterion was somewhat smaller in the independent school group than in the public school group, but still quite high: .73. The correlations for the three subdivisions within the independent school group, taken separately (the first combining small groups from four schools, and the other two representing single schools), were .79, .81, and .80, respectively.

The attainment of correlations of this magnitude was dependent on the use of adjusted college marks as a criterion, rather than the unadjusted college marks. Success in college, as measured by freshman grades, would have been insufficiently defined without some means of taking into account the differing character of each of the various colleges involved. When the measures of success were adjusted in a way that made allowances for the differences among colleges, it was possible to make much more accurate predictions of college success from high school data.

The rank in class, expressed as a percent of the number of students in the senior class, gives correlations with the criterion of practically the same size

as the correlations for the average mark. This is not unexpected, since presumably the school marks are the major determiners of rank in class. For the total group, where large variations in size of class occur, the relative size of the correlations with the criterion for ordinal and for percentage rank (.39 as compared with .76) emphasizes the need to consider a pupil's rank in terms of percentile rank, or at least in terms of proportion of the class - e.g., in top tenth, or in third quarter - rather than simply as second or tenth man in the class.

For the independent school group, the four-year average of all achievement test percentiles is not far below the four-year average mark as a predictor of college marks, giving a correlation of .70 as compared with .73 for high school marks. However, the difference is greater for the public schools. In the individual subject areas also, the superiority of marks over test results is more pronounced in the public schools than in the independent schools. In fact, for the independent schools, there is one area, the foreign languages, where the test results exceed the course mark in predictive value; the foreign language test percentile is not only better than the mark in that area as a predictor, but it is practically as good as the general average of test results in all subjects. In the public school group, the foreign language test result does not give as high a correlation with the criterion as does the school mark, but the correlation is higher than that of any of the other test results for single subjects. Among the course marks for individual subjects, social studies is the best predictor in the independent school group, while English is best for the public school group.

The predictive value of single-grade aptitude and reading test results is not as great as that of achievement test averages for single grades, the correlations centering around .50. Also, combining the results for several years (cumulating either forward or backward) produces only a slight increase in the correlations with the criterion. In fact, for the independent schools, the aptitude test

results for grade 9 alone yielded a correlation with the criterion that is a little higher than that for grade 10, and practically as high as the average for three years or for four years.

Another result that may be somewhat surprising is that average measures in each of the last three secondary grades yield very nearly the same correlations with the criterion. Grade 10 achievement is almost identical in predictive value with grade 11 or grade 12 achievement, as measured either by marks or by test results, and is not greatly inferior as a predictor to the four-year average. This finding could have an important bearing on guidance procedures, as it seems to indicate that an evaluation of probable success in college, based on information available as early as the end of grade 10, may give good results.

Although the predictive value of the aptitude and reading test results is relatively low for the particular sample in this study, similar results might not be found in other types of schools. If the particular schools in this study are doing an especially good job of helping certain students to make up for lack of ability by extra effort and study, it is possible that aptitude measures alone in these schools would not show as close a relation to college achievement as might be the case in some other kinds of schools.

As compared with the results of the aptitude tests given in the course of the regular school testing (the ACE Psychological Examination), the verbal scores on the CEEB Scholastic Aptitude Test exhibit a closer relationship to the adjusted criterion, the correlation being .60 for the independent school group and .61 for the public school group. The correlations of the CEEB mathematical score are lower (.44 and .34 respectively), but each of the two part-score correlations is nevertheless higher than the correlations of the corresponding part scores on the ACE examination, for either grade 12 alone, or the four-year average. The correlations with the criterion of the various CEEB achievement tests (many based on rather small numbers of cases) range from .32 for physics (for 15 independent

school pupils) and .35 for mathematics (for 56 public school pupils) to .68 for social studies (for 52 independent school pupils). The corresponding figures for the four-year averages of achievement tests taken in the regular annual programs of the schools, and based on the total group of pupils, cover about the same range, from .40 for social studies in the public school group to .69 for foreign languages in the independent school group.

Many of the intercorrelations among various measures were so high that little increase in efficiency of prediction, as indicated by a multiple correlation with the criterion, could be expected from the combination of several measures into a composite. However, multiple correlations for a few of the most promising measures were computed. For both the independent and the public school groups, the four-year average mark and the four-year average achievement test percentile are among the best predictors. For the independent school group, a combination of these two measures yields a multiple correlation with the criterion of .78, which represents an improvement over either of the two measures alone, since their correlations with the criterion are .73 and .70, respectively. For the public school group, however, the multiple correlation resulting from a combination of these two measures is just the same as the correlation of the marks alone: .78.

For the independent school group, all of the other combinations for which multiple correlations were computed yielded only slight increases in the correlation with the criterion, as compared with that of one of the component measures alone, and none of these multiple correlations was as high as that for the combination of four-year grades and four-year achievement test results.

For the public school group, no combinations of other variables were found that would yield a multiple correlation as high as the correlation for four-year average marks alone. However, it is interesting to find that, for both independent and public school groups, the multiple correlation with the criterion

resulting from a combination of four-year average English mark and four-year average social studies mark is practically the same as the correlation for the four-year average of marks in all subjects: for the independent schools, .72 as compared with .73, and for the public schools, .77 as compared with .78.

Additional analyses were made for separate groups, divided according to sex, and also according to type of college attended. The separate correlations for boys and for girls did not show any very marked departures from the results for the total group; as a general rule, grades were better predictors for boys than for girls, while test results were better predictors for girls than for boys.

When the correlations for different types of college were studied, the results confirmed the superior predictability of the adjusted college grade, as compared with the uncorrected grade, whenever a varied group of colleges is involved. Differences between types of college in the measures that provided the best predictions were not especially noteworthy; percentage rank in class and overall average high school grade (adjusted) were among the best predictors for practically all types of college.

In addition to the listing and discussion of correlation coefficients, several expectancy tables were presented, based on the results for the pupils in this sample. These tables show the chances in 100 of making a particular college grade, given the results of one of the following high school measures: four-year average high school mark (adjusted); four-year average achievement test percentile (independent school norms); rank in class; score on verbal part of the CEEB Scholastic Aptitude Test; and score on mathematical part of the CEEB Scholastic Aptitude Test. An additional table gives an indication (based on independent school pupils only) of what may be expected in the way of average achievement test results in the twelfth grade, on the basis of ninth grade aptitude test percentiles.

To sum up, the following points may be selected as among the more interesting results of this study:

1. Exceptionally good predictions of college success, as measured by average freshman grades, can be made from secondary school course marks and achievement test results, if the grades from different institutions, with varying standards and methods of grading, are put on a common scale by means of conversion procedures such as those reported in the study developed by Dr. Bloom. Correlations of many of the predictor variables with the adjusted criterion are between .70 and .80, with one or two coefficients reaching .81 and .82 for particular groups. These are much higher than the correlations with unadjusted grades, which are of about the same magnitude as those usually found between measures of these kinds.

2. The CEEB Scholastic Aptitude Test scores are more closely associated with college grades than are the results of the ACE Psychological Examination taken during the regular testing programs in the schools, but neither one of these aptitude tests approaches the achievement test results in predictive value. The correlations of reading test scores with the criterion are of about the magnitude as those of the ACE test.

3. School marks predict the criterion more accurately for boys than for girls. Test results predict better for girls than for boys.

4. As a general rule, school marks furnish a somewhat better prediction of college success than do achievement test results; the difference is not great for the independent school pupils, but is larger for the public school groups.

5. After grade 9, either achievement test results or course marks for any one year are about equal to those for any other year, and are not greatly inferior to four-year averages in predictive value. The fact that the tenth grade measures give about as good predictions as those for grade 11 or grade 12 should encourage early formulation of college plans, since it appears that good college material may be identified with some accuracy as early as the tenth grade.